MEMORANDUM FOR: Bill,

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FORM NO. 101 REPLACES FORM 10-101
1 AUG 54 WHICH MAY BE USED. (47)

Superimposition without correction of relief displacement would result in a combined image in which corresponding parts of the image do not match. Correct superimposition requires corresponding parts of the image to be sensed and correctly displaced. This can only be done by using fast-acting correlation circuitry that is capable of displacing small sections of imagery differentially. A method of implementing this fast-acting correction on the ARES viewer known as reverbatory integration has been suggested

25X1 [redacted] and is presently under development. It appears possible to correct the displacement of areas as small as 12 resolution elements, i.e. 6 video cycles using this technique. The effect is similar to the use of transformations up to about 40th order.

We propose to use a similar technique in the superimposition viewer. The use of transformations of up to 40th order will correct for any conceivable natural terrain relief, even in the most rugged areas, and should go a long way toward correcting relief due to man-made objects.

Illumination Variations

25X1 The problem of shadow suppression was discussed at some length in Technical Proposal [redacted] dated 3 December 1964. We consider this to be a serious but not insuperable problem, and propose to investigate the electronic methods of shadow suppression discussed in that document, which are based on obtaining a non-linear video transfer character. The same general approach will also combat illumination variations due to cloud shadows, time of day, etc.

Weighting

The purpose of weighting the inputs is to eliminate the possibility of otherwise good material being degraded by one or more inputs of poor quality. It is possible for photography obtained in a single mission to have varying quality in the various frames. It is thus important that the quality of each frame be checked and weighting adjusted accordingly.

25X1 A practical case showing the necessity for weighting can be quoted from [redacted] experience with the Three-Input Integrating Printer. This is an optical device designed to superimpose three negatives containing the same imagery onto a single print, the purpose being to improve the contrast and legibility of small detail due to averaging of the grain structure. Assuming a random grain structure, the improvement in contrast should amount to $\sqrt{N}$ where N is the number of negatives superimposed. The equipment referred to used a special 3-camera assembly for obtaining the negatives which were then superimposed and printed. It was found that the actual increase in contrast of detail amounted to about 40% instead of the 73% expected. The cause was traced to one of the inputs being slightly out of focus and therefore degrading the superimposed output.

This phase of the study will include an analysis of the effect of variations in contrast, resolution, illumination and film grain on the final image. This will enable weighting criteria to be set up for the input material. The final stage will be development of suitable electronic or optical techniques for measurement of the required criteria in each input frame and adjustment of its weighting.

Feasibility Demonstration

25X1 Feasibility of electronic image superimposition can be demonstrated most quickly by using an [redacted] ARES viewer with two input channels, suitably modified as discussed in the previous paragraphs.

Use of this equipment will enable the effectiveness of electronic correction of frame geometry, relief displacement, shadow suppression and input weighting to be evaluated. However, in order to provide conclusive evidence of the ultimate benefits of ARES controlled multiple image integration, a larger number of inputs must be handled subsequently.

The next step after a demonstration of the feasibility of electronic techniques would therefore be the construction of an image integration device with at least three input channels, as described as Phase II of the previously submitted proposal.